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Introversion and Human-Contaminant Disgust Sensitivity Predict Personal Space

Justin H. Park

School of Experimental Psychology

University of Bristol

12a Priory Road

Bristol BS8 1TU

United Kingdom

E-mail: j.h.park@bristol.ac.uk

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Abstract

How far do people prefer to stand from others during interpersonal interactions? Individuals vary in what has been termed *personal space*, and this variation appears to be systematic. For instance, personal space tends to be larger among more introverted individuals. The present study investigated whether personality variables relevant to threat perceptions may predict personal space. One type of threat that may be neutralized via physical distancing is infectious disease. This study examined whether individual differences in pathogen-relevant disgust sensitivity (particularly with respect to other humans) may predict personal space. In a study employing a behavioral measure of personal space ($N = 134$), human-contaminant disgust sensitivity (but not nonhuman-contaminant disgust sensitivity) was found to predict personal space while controlling for trait anxiety and introversion. Introversion was found to exert an independent predictive effect.

Keywords: behavioral immune system; disease avoidance; disgust; introversion; personal space

1. Introduction

Many infectious diseases are transmitted via physical contact; many others (such as measles and influenza) can be transmitted via mere proximity (from coughs and sneezes). Avoiding disease carriers would thus be adaptive. Indeed, recent research has demonstrated that the first line of defense against infectious disease is located in the nervous system—what has been referred to as the “behavioral immune system” (Schaller & Park, 2011). Like many other animals (Hart, 2011), humans are endowed with a suite of psychological mechanisms that facilitate the detection and avoidance of sources of contaminants, including conspecifics. The behavioral immune system has been implicated in many disease-specific defensive responses (e.g., Mortensen, Becker, Ackerman, Neuberg, & Kenrick, 2010; Park, Schaller, & Crandall, 2007). The most obvious means of avoiding infection is maintaining a physical buffer, to keep sources of infection at a safe distance. This may shed new light on the phenomenon of *personal space*, a trait-like variable pertaining to the imaginary zone that individuals wish not to have invaded by others. The present study tested the novel hypothesis that an individual-difference variable central to the behavioral immune system—disgust sensitivity—may predict the magnitude of personal space.

Several decades ago, there was substantial academic interest in the concept of personal space. Researchers investigated whether personal space may vary depending on cultural background, sex, and age; experiments were conducted to examine effects of contextual variables on personal space (for reviews, see Evans & Howard, 1973; Hayduk, 1978, 1983). With respect to personality traits, a number of studies yielded intuitively sensible results. For instance, neuroticism and introversion—variables which may be relevant to self-protection—were found to predict personal space (De Julio & Duffy, 1977; Pedersen, 1973), although it must be noted that there have been many inconsistent findings involving personality traits (see Hayduk, 1983). It should also be noted that several different methods

have been used to measure personal space, although all of them are subjective measures, relying on the phenomenological experience of participants (e.g., approaching a target and stopping at a comfortable distance).

Surprisingly, few studies seem to have examined personality variables directly relevant to threat appraisal and self-protection. One study examined the effect of anxiety (measured using the Rorschach method) and found no predictive effect on personal space (Dosey & Meisels, 1969). More recently, Sambo and Iannetti (2013) reported a positive correlation between trait anxiety (measured using the State–Trait Anxiety Inventory) and *defensive peripersonal space* (DPPS). At first glance, DPPS and personal space may appear to refer to the same phenomenon (indeed, media coverage of Sambo and Iannetti’s article referred to “personal space,” a term that the authors themselves never used). However, DPPS is defined more strictly in terms of defending oneself from an immediate threat, and its measurement relies not on subjective perceptions but on the involuntary hand-blink reflex (Sambo, Liang, Cruccu, & Iannetti, 2012). And because no study has assessed the relationship between DPPS and personal space (as traditionally conceptualized), it would be premature to conclude that the finding associated with DPPS pertains directly to personal space.

Notably, no previous study has examined the effect of disgust sensitivity on personal space. From the perspective of the behavioral immune system, disgust is central to physical distancing from sources of threat (Curtis, Aunger, & Rabie, 2004). Not only does disgust motivate physical distancing, variation in disgust sensitivity may constitute prophylactic responses to variation in physiological immunocompetence—specifically, individuals with weakened immune responses may experience compensatory increases in disgust sensitivity (Fessler, Eng, & Navarrete, 2005; Fleischman & Fessler, 2011). Of course, heightened disgust sensitivity can serve a prophylactic function only to the extent that it impels

avoidance behavior, and thus one straightforward hypothesis is that individuals higher in disgust sensitivity may prefer larger distances from sources of infection, including other people.

There exist several measures of disgust sensitivity. The pathogen disgust subscale of the Three-Domain Disgust Scale (TDDS; Tybur, Lieberman, & Griskevicius, 2009) was developed specifically to assess individual differences in disgust sensitivity pertaining to the behavioral immune system (i.e., the motive to avoid sources of pathogens). Two other subscales from the TDDS measure sexual disgust and moral disgust, and these correlate only modestly with pathogen disgust. Notably, several studies have found that pathogen disgust (but not sexual or moral disgust) predicts various disease-relevant responses (e.g., DeBruine, Jones, Tybur, Lieberman, & Griskevicius, 2010; Park, Van Leeuwen, & Stephen, 2012).

In a recent article, Gangestad and Grebe (2014) argued that the concept of the behavioral immune system—and pathogen disgust sensitivity—may be too broad. Specifically, they argued that there may be distinct responses to human contaminants and nonhuman contaminants. In fact, the pathogen disgust subscale contains items pertaining to both human- and nonhuman-contaminants, allowing assessment of whether the two constructs can be distinguished, and Gangestad and Grebe found some evidence of dissociation between the two types of disgust sensitivity. To the extent that personal space pertains to other people, a more specific hypothesis can be derived—that human-contaminant disgust sensitivity may uniquely (or more strongly) predict personal space. The present study tested this hypothesis. As noted above, introversion and trait anxiety may predict personal space as well—possibly for self-protective reasons—making it important to assess the effect of disgust sensitivity while controlling for these variables. Thus, measures of introversion and trait anxiety were included as well.

2. Method

2.1. Participants

Participants were 134 undergraduate students at a UK university (108 women, 25 men, 1 did not indicate gender; mean age = 19.71, $SD = 4.17$). The study sessions took place in a large computer lab in a classroom context. Each session consisted of approximately 45 students. Prior to the study, approval was obtained from the university's Research Ethics Committee.

2.2. Measures

2.2.1. Personal space

A behavioral measure of personal space was obtained, using a version of the stop-distance procedure which is known to have high test-retest reliability (Hayduk, 1978, 1983). From a starting distance of approximately 2 m, each participant walked toward a stationary target individual (another student) and stopped at a distance felt to be comfortable for a casual conversation. Using a 1-m tape measure, the participant and the target measured the abdomen-to-abdomen distance to the nearest cm. To increase reliability, each participant repeated this process with three different targets (Cronbach's $\alpha = .92$).

2.2.2. Introversion

From the Big Five Inventory (John, Naumann, & Soto, 2008), eight items measuring Introversion-Extraversion (three of which were reverse scored) were used ($\alpha = .86$). Participants rated items such as "I see myself as someone who is reserved." Ratings were

made on a 4-point scale (disagree strongly, disagree a little, agree a little, agree strongly).

Higher scores denoted greater introversion.

2.2.3. Disgust sensitivity

From the Three-Domain Disgust Scale (Tybur et al., 2009), seven items measuring Pathogen Disgust were used ($\alpha = .66$). Participants rated items such as “Stepping on dog poop.” Ratings were made on a 4-point scale (not at all disgusting, slightly disgusting, somewhat disgusting, very disgusting). Higher scores denoted greater disgust sensitivity. Four of the items refer to other people (“red sores,” “sweaty palms,” “body odor,” “bloody cut”) and the other three do not (“dog poop,” “mold,” “cockroach”), which enabled calculation of human-contaminant ($\alpha = .53$) and nonhuman-contaminant ($\alpha = .49$) pathogen disgust scores (see Gangestad & Grebe, 2014).

2.2.4. Trait anxiety

From the State–Trait Anxiety Inventory (Spielberger, Gorsuch, Lushene, Vagg, & Jacobs, 1983), 20 items measuring Trait Anxiety (nine of which were reverse scored) were used ($\alpha = .89$). Participants rated items such as “I feel nervous and restless.” Ratings were made on a 4-point scale (almost never, sometimes, often, almost always). Higher scores indicated greater trait anxiety.

2.3. Procedure

For the behavioral measure of personal space, participants worked in groups of four or five. After receiving detailed instructions on the measurement of personal space, participants measured their own personal space and served as a target for their group members’ measures. Participants and targets were instructed not to talk to each other during the walking-and-

stopping part of the measurement. Upon obtaining the required three measures of personal space, participants completed the rest of the study on individual computers. Via an online survey, they entered their personal space measures and completed the questionnaires.

3. Results and Discussion

Table 1 shows the descriptive statistics and correlations. Consistent with previous research, greater introversion was associated with larger personal space ($r = .22, p = .011$). Interestingly, human-contaminant disgust sensitivity was marginally correlated with personal space ($r = .17, p = .053$), whereas nonhuman-contaminant disgust sensitivity was uncorrelated with personal space ($r = -.020, p = .82$). Although trait anxiety was correlated with introversion and human-contaminant disgust sensitivity, it did not predict personal space ($r = .024, p = .78$).

To examine the independent predictive effects of the variables, a regression analysis was conducted in which introversion, human-contaminant disgust sensitivity, nonhuman-contaminant disgust sensitivity, and trait anxiety were simultaneously entered as predictors, with personal space serving as the criterion variable. The analysis (model $R^2 = .10, F[4, 129] = 3.64, p = .008$) revealed significant predictive effects of introversion ($\beta = .28, p = .004$) and human-contaminant disgust sensitivity ($\beta = .25, p = .012$); nonhuman-contaminant disgust sensitivity ($\beta = -.15, p = .12$) and trait anxiety ($\beta = -.15, p = .13$) exerted no predictive effects.

These results indicate that introversion and human-contaminant disgust sensitivity exert independent predictive effects on personal space. Although these results should be treated as preliminary, a clear pattern can be discerned. In addition to replicating the predictive effect of introversion, this study is the first to demonstrate an association between disgust sensitivity and personal space, which was independent of the effect of introversion. While it has been suggested that introversion may—via general social reticence—serve a

disease-avoidance function (Mortensen et al., 2010; Schaller & Murray, 2008), introversion does not explain the effect of disgust on personal space in this study, which suggests that introversion may be associated with personal space for reasons other than disease avoidance. More importantly, the effect of disgust sensitivity was found to be highly specific. Not only is the effect not explained by disease-irrelevant sensitivity to threat (trait anxiety), it is also not explained by disgust sensitivity to nonhuman contaminants (e.g., dog feces). There appears to be a distinct disgust sensitivity to human contaminants (e.g., wounds), and this is what explains personal space size. Thus, one function of personal space may be the avoidance of infectious disease.

One might argue that the association between human-contaminant disgust and personal space can be explained by the fact that personal space was measured using human targets. Indeed, a reasonable prediction is that nonhuman-contaminant disgust may be uniquely associated with “personal space” measured using nonhuman targets (e.g., feces, moldy food), which would demonstrate a double dissociation. That prediction remains to be tested. In any case, “personal space” has always been defined in terms of other humans, so further theoretical development and empirical research would be needed to elucidate different types of personal space, if they exist.

Future research could extend the present findings in a number of ways. First, the distinction between human-contaminant and nonhuman-contaminant disgust sensitivity must be validated, perhaps with a new or expanded measure of disgust sensitivity. Second, possible moderating effects of target characteristics on the correlations could be examined. For instance, high levels of attraction or aversion to the target may disrupt the predictive effects of trait disgust sensitivity. Third, human-contaminant disgust sensitivity could be experimentally manipulated to test its causal effects on personal space size. Finally, the link between personal space and DPPS could be investigated. Sambo and Iannetti’s (2013) finding

may demonstrate that trait anxiety (as a propensity to engage in fight–flight response) is closely linked to perceptions of immediate threats. On the other hand, human-contaminant disgust sensitivity may be more relevant for subjectively experienced distances to other humans. Clearly, additional research is needed to map the different kinds of defensive zones and their correlates.

Many variables likely influence the distance at which people feel comfortable when interacting with others. Among individual-difference variables, the results of the present study point to introversion and human-contaminant disgust sensitivity as important contributors.

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Table 1

Descriptive statistics and correlations

	<i>M</i>	<i>SD</i>	2.	3.	4.	5.	6.
1. Personal space	41.82	9.23	.22*	.10	.17	-.02	.02
2. Introversion	2.19	0.61		.12	.09	.11	.43***
3. Pathogen disgust	2.61	0.50			.88***	.82***	.22*
4. Human-contaminant disgust	2.47	0.56				.45***	.26**
5. Nonhuman-contaminant disgust	2.80	0.62					.10
6. Trait anxiety	2.15	0.46					

Note. Personal space was measured in cm. All other variables were measured on a 1–4 scale. * $p < .05$, ** $p < .01$, *** $p < .001$.